

WASHINGTON

SCIENCE TRENDS

HIGHLIGHTS

- PROJECT VELA
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* PROJECT VELA -- A SPECIAL REPORT

The Federal Government plans to spend some \$66 million during the next year for a worldwide research and development program on the complex technical problems associated with detection of nuclear testing.

The program includes a \$2 million project to provide modern equipment for virtually all of the Free World's seismic stations -- a project which may run into difficulty because of the U-2 reconnaissance plane program in which military missions were masked as peaceful weather research. Vela is sponsored by the Advanced Research Projects Agency of the Department of Defense, and the Atomic Energy Commission.

Here is a Special Report outlining the status and future plans of Project Vela:

o Vela Uniform: This is the designation of the research and development tasks concerned with the detection of underground nuclear explosions. This part of Project Vela is already well underway. Geotechnical Corp., Dallas, Tex. is building at Ft. Sill, Oklahoma a prototype detection station such as the one agreed upon by experts of the U. S., U. K. and U.S.S.R. during the Geneva Conference. A second station, with a number of modifications, has been the subject of a bidder's conference, with no contractor selected to date. Both stations will be employed to test new techniques and refine and analyze existing detection methods.

Research Programs on the generation and propagation of seismic waves are also being planned or carried out under the direction of the Air Force Technical Applications Center. Contracts with universities and research organizations will include about \$2 million for basic studies of such subjects as shear waves, after shocks, crystal studies, etc. Another \$1,250,000 will be placed into efforts to develop improved detection methods and equipment. A major goal here will be improvement of definition, particularly of very long period waves which are difficult to distinguish.

Contracts in connection with Vela Uniform also include studies by Sandia Corp. and Bell Telephone Laboratories on the feasibility of using unmanned seismic stations to extend the capabilities of the detection network; technical studies by the Rand Corp. of the seismic threshold problem and feasibility studies of large arrays by United Electro-Dynamics, Inc. with the goal of increasing the detection capability of detection stations.

World-Wide Standard Seismic Network, detailed in this Special Report, will also be a part of Vela Uniform.

6 Vela Sierra: This is the designation of the research and development tasks concerned with the ground-based detection of nuclear tests in space. Contracts here include a study by Edgerton, Germeshausen & Grier, Inc., Boston, Mass., on possible detection through optical, or direct visible light techniques. Others are to include possible detection through air fluorescence, ionospheric disturbances and electromagnetic effects.

6 Vela Hotel: This study contract by the Air Force Ballistic Missile Division with Space Technology Laboratories is concerned with the feasibility of remotely detecting nuclear detonations in space and in particular, beyond the Moon. The possibility is being studied of instrumenting satellites and space probes to determine the amount of radiation emitted from a nuclear detonation as compared with natural radiation background or environments. Other problems include the sensitivity of the detection system sensors and associated electronic instrumentation and the degree of shielding or other countermeasures which might be used to conceal nuclear explosions.

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* WORLD-WIDE NETWORK

The Advanced Research Projects Agency plans to spend \$2 million during the coming year to equip approximately 125 seismic stations throughout the free world with modern and uniform instrumentation. Each station will receive title to the equipment without obligation -- other than agreeing to maintain and operate the instruments, and to cooperate fully in the free exchange of data.

A possibility exists that this program may be impeded because of disclosures that U-2 aircraft were being flown on military missions under the guise of peaceful weather research by the National Aeronautics and Space Administration.

In the seismic program, the funds will come from military agencies but will be administered by the U. S. Coast and Geodetic Survey, a civilian agency. The program will also be advertised as a peaceful scientific venture -- although it could have profound affects on the detection of underground nuclear explosions.

Specifications for the station equipment have now been set forth by a special committee of the National Academy of Sciences. They call for instruments that can be procured without extensive development which can cover the "most useful" part of the spectrum without resorting to equipment of a very special type. However, a continuing program of research and development in seismological instrumentation is recommended.

Equipment: The special committee suggests two sets of so-called three-component instruments; one short-period set with high magnification, and a relatively long-period set with moderate magnification. The three must be carefully matched for period response and magnification at each station and must be calibrated so that response at each station will be the same.

Electromagnetic seismometers recording through galvanometers with conventional photographic drums are said to be the most satisfactory. The same drum rates, direction of paper transport, and ground-motion conventions are recommended for all of the stations. The committee also suggests that high quality electronic clocks and radio receivers be supplied with the seismographs so that all stations will have time service of uniformly high quality. The Coast and Geodetic Survey, it is suggested, should have funds to file and copy all seismic records, and each station wishing to keep records should have record-copying facilities made available.

* DIGITAL COMPUTERS FOR RESEARCH

Experience with a small electronic digital computer using punched cards leads Bureau of Mines researchers to recommend the use of such equipment to others who may now be using desk calculators.

Staff members of the Bureau's Pyrometallurgy Laboratory, Bruceton, Pa. conclude that "small computers are useful and economical for solving a much broader range of problems in scientific calculations than is generally appreciated by scientists who are unfamiliar with the versatility, speed and low cost of electronic computing."

The well-publicized accomplishments of multimillion dollar machines manned by skilled specialists tend, it is suggested, to discourage researchers who have no need for such extensive facilities. The Bureau scientists point out, however, that the penetration of electronic automatic computing into the business machine market has spurred the design of small computers that can be used as practical tools for most laboratories.

Their conclusion: "Small computers not only are suitable for solving a broad range of scientific problems including many that arise frequently, but also hold out definite possibilities for marked reductions in cost compared to desk-calculated work. They also offer assurances of faster answers, improved accuracy and continued accessibility of data. In a laboratory where the volume and monetary value of computer traffic is far too low to consider the installation of a large computer a small computer has been unquestionably beneficial and economical in solving a wide variety ...of problems."

(Further details, including a discussion of problems and typical solutions in minerals research, available. 26 Pages. 40 cents. Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for Bureau of Mines Information Circular 7959 -- Applications of a Small Electronic Digital Computer to Pyrometallurgical Research)

* LUNAR GUIDANCE PROBLEMS

Studies for the National Aeronautics and Space Administration indicate that a number of problems have been raised by the requirement that only biologically sterilized payloads impact the Moon's surface during the forthcoming Ranger series of lunar flights.

The payload, or spacecraft, will be sterilized in accordance with international agreements not to contaminate the lunar surface. However, the Agena vehicle which will be used for such missions will not be sterilized.

Research at the Jet Propulsion Laboratories indicates that the standard 66-hour trajectory expected to be used can be designed to miss the Moon -- while the spacecraft payload is brought back to the proper trajectory by an impulse applied with the midcourse rocket.

It is believed that this can be accomplished at the same time as the regular midcourse maneuver which is planned to compensate for random errors connected with launching. This would require a minimum speed capability of 166 ft/sec -- sufficient to compensate for 99 percent of possible injection guidance errors while insuring that the probability of the separated Agena final stage hitting the Moon is less than 1%.

As an alternative, the final stage and payload could be injected on a lunar impact trajectory. Then, after separation, the last stage could be diverted from the Moon by a small impulse of 30 ft/sec.

* MISSILE RADIATION CENTER

A Ballistic Missile Radiation Analysis Center (BAMIRAC) has been established at the Willow Run Laboratories of the University of Michigan under contract with the Pentagon's Advanced Research Projects Agency (ARPA).

The center receives and analyzes radiation data from a number of sources and uses this information to develop mathematical models which describe a missile by its "behavior". It is hoped that comparing data from an unknown missile with such a model could lead to identification of the missile.

Ballistic missiles in flight cause various disturbances resulting in reflection, absorption and generation of electromagnetic energy. In addition, plasmas are created which can also reflect and generate radiowaves at various frequencies.

* ATMOSPHERIC RESEARCH CENTER

National Science Foundation has signed a \$500,000 contract for establishment of a National Center of Atmospheric Research to be headed by Walter Orr Roberts, presently with the High Altitude Observatory, Boulder, Colo.

National Center proposal has been sponsored by an all-university corporation including Arizona, California, Chicago, Cornell, Florida State, Johns Hopkins, MIT, Michigan, NYU, Penn State, St. Louis, Texas A&M, Washington (Seattle) and Wisconsin.

Roberts will employ a senior scientific staff of perhaps eight to ten individuals, rent facilities and plan a research program in consultation with university and other scientists. Programs are expected to fall into four major categories -- atmospheric motions, energy exchange processes in the atmosphere, water substance in the atmosphere and physical phenomena.

Financing for the Center has met with difficulties in Congress. The group was criticized in some quarters for using preliminary study funds to prepare a highly-detailed building plan, including the type of floor tile to be used in laboratories and the required number of gardeners.

* NASA RESEARCH GRANTS

National Aeronautics and Space Administration (NASA) has appointed Thomas L. K. Smull as its Director for Research Grants and Contracts. The office coordinates basic research programs and initiates and coordinates all business management relations with nonprofit scientific and educational institutions. The appointment also signals a change in policy -- the office will become a part of NASA's Business Administration section and will serve research needs of all NASA's major programs -- not only advanced research, its previous domain. In addition, technical monitoring and business administration of certain grants and contracts will now be shifted to the NASA field centers where most of the interested technical staff would be located.

* WEATHER RECONNAISSANCE

U. S. Air Force will soon cut by 40 percent its regular weather reconnaissance flights in the Pacific, and will eliminate the program entirely by 1963. U. S. Weather Bureau is taking steps to provide merchant ships in the area with upper-air instrumentation facilities. Bureau is also taking steps to provide magnetic tape and microfilm recording of all satellite weather reconnaissance photos at its Asheville, N. C. National Weather Records Center.

* ELECTRIC FUSING

The Navy is providing electric fusing as a so-called "back fit" item for its low-drag bombs. This modification is expected to eliminate the operational restrictions which mechanically-fused bombs impose on combat aircraft speeds.

RESEARCH CHECKLIST

- () PARTICLE SIZE ANALYSIS: Studies sponsored by the Atomic Energy Commission are said to have resulted in development of a new instrumental technique for automatic particle size analysis. The system is said to be safe, non-destructive and adaptable for continuous on-stream sampling in dry or liquid state without affecting production flow. System is based on a beta-ray back-scattering technique which measures the magnitude of fluctuations or the "spread" in a random sampling operation under specific geometrical conditions with a Carbon 14 source.
- (R&D by Radioisotope Laboratory, Evans Research and Development Co. N.Y. sponsored by Office of Isotope Development, U. S. Atomic Energy Commission)
- () LEONARDITE RESEARCH: U. S. Bureau of Mines is currently studying leonardite, a little-known mineral which occurs in association with lignite. Leonardite has been used in oil-drilling muds, in water treatment and in certain wood stains. High humic acid content has recently led to considerable experimental use as a combination soil conditioner and fertilizer. Bureau researchers have been able to produce artificial leonardite by oxidizing lignite under controlled conditions.
- (Report Available. Single Copies Free. Write Publication-Distribution Section, U. S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa. for Report of Investigation No. 5611 -- Leonardite)
- () PHOTO TRANSMISSION SYSTEM: An advanced photo transmission system said to be adaptable for all presently known or planned drones and manned aircraft is being developed for the U. S. Army Electronic Proving Grounds at Ft. Huachuca, Ariz. The 70mm system is designed to automatically take aerial photographs for relay to field commanders. Transmission time is expected to be three seconds after an initial start-up delay which may vary up to a maximum of two minutes. The ground terminal of the new system will accept inputs from both infrared and radar as well as photographic sensors.
- (R&D by Fairchild Camera and Instrument Corp., Syosset, L. I., N. Y.)
- () AUTOMATIC TRACKING THEODOLITE: Army researchers have developed an automatic tracking theodolite to provide a rapid method of extending geodetic control where line-of-sight-between stations cannot be established. The system, to be used primarily by field artillery and topographic units, is said to be capable of automatically pointing on stationary targets and automatically tracking fast-moving airborne lights. Three units are required -- two located at the ends of established baseline and the other at a point whose position is to be determined. A central computer station is connected to all theodolite stations by a radio data-transmission link. System is expected to be available for troop use in 1961.
- (R&D by U. S. Army Engineer Research and Development Laboratories, Corps of Engineers, Ft. Belvoir, Va.)
- () NITRIDING TITANIUM: Studies for the U. S. Navy Bureau of Weapons indicate that nitriding gives a desirable high hardness to the surface of commercially pure titanium but can adversely affect certain alloys. The findings have resulted in experimental production of fuel control valves for jet engines of carrier based aircraft. The nitrided titanium parts have displayed good performance characteristics, according to the National Bureau of Standards.

P U B L I C A T I O N C H E C K L I S T

- () MINERAL FACTS AND PROBLEMS -- an all-new edition of this standard Government guidebook and encyclopedic reference on metals, nonmetals and mineral fuels and the industries that produce them. 1000 pages. \$6. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C., for Bureau of Mines Bulletin 585.

- () MINERAL FACTS AND PROBLEMS -- Individual Chapters are available from the Superintendent of Documents at the price indicated below:

Introduction -----	10¢	Gold -----	10¢	Radium -----	5¢
Alumina & Bauxite --	10¢	Graphite -----	10¢	Rare-Earth Metals -----	10¢
Aluminum -----	15¢	Gypsum -----	10¢	Rhenium -----	5¢
Anthracite -----	15¢	Hafnium -----	5¢	Rubidium -----	5¢
Antimony -----	10¢	Helium -----	10¢	Sand & Gravel -----	15¢
Arsenic -----	5¢	Indium -----	5¢	Scandium -----	5¢
Asbestos -----	10¢	Iodine -----	5¢	Selenium -----	5¢
Barium -----	10¢	Iron -----	15¢	Silicon -----	10¢
Beryllium -----	10¢	Kyanite & Related		Silver -----	10¢
Bismuth -----	10¢	Minerals -----	5¢	Sodium & Sodium	
Bituminous Coal ----	20¢	Lead -----	15¢	Compounds -----	15¢
Boron -----	10¢	Lignite & Peat ----	10¢	Steel -----	20¢
Bromine -----	5¢	Lime & Calcium -----	10¢	Stone -----	15¢
Cadmium -----	10¢	Lithium -----	10¢	Strontium -----	5¢
Cement -----	10¢	Magnesium &		Sulfur & Pyrites -----	10¢
Cesium -----	5¢	Magnesium Compounds	10¢	Talc, Soapstone,	
Chromium -----	15¢	Manganese -----	15¢	Pyrophyllite -----	10¢
Clays -----	10¢	Mercury -----	10¢	Tantalum -----	5¢
Cobalt -----	10¢	Mica -----	15¢	Tellurium -----	10¢
Columbium -----	10¢	Molybdenum -----	10¢	Thallium -----	5¢
Copper -----	20¢	Nickel -----	15¢	Thorium -----	10¢
Corundum & Emery ---	5¢	Nitrogen Compounds --	10¢	Tin -----	10¢
Diamond-industrial -	10¢	Oil Shale -----	10¢	Titanium -----	15¢
Diatomite -----	10¢	Perlite -----	10¢	Tungsten -----	15¢
Feldspar -----	10¢	Petroleum & Nat. Gas	20¢	Uranium -----	15¢
Ferroalloys -----	10¢	Phosphate Rock -----	10¢	Vanadium -----	10¢
Fluorine -----	10¢	Platinum-Group Metals	10¢	Vermiculite -----	10¢
Gallium -----	5¢	Potassium Compounds -	10¢	Water -----	10¢
Garnet -----	5¢	Pumice -----	5¢	Yttrium -----	5¢
Gem Stones -----	15¢	Quartz Crystal -----	10¢	Zinc -----	15¢
Germanium -----	5¢			Zirconium -----	10¢

- () SCIENTIFIC INFORMATION, an outstanding Congressional report on programs in Industry, Government and Educational institutions concerned with scientific information gathering and retrieval systems. Includes much detail on new programs and technical progress in such organizations as Avco Corp., Bell Telephone, duPont, General Electric, IBM, Recordak and others. 283 pages. Single Copies Free. (Write Committee on Government Operations, U. S. Senate, Washington 25, D. C. for Report -- Documentation, Indexing and Retrieval of Scientific Information.)
- () MECHANICAL TRANSLATION RESEARCH, a transcript of statements, testimony and exhibits presented to a Congressional committee looking into various Government-sponsored programs in the mechanical translation field. A valuable supplement to the Senate report listed above. 183 Pages. Single Copies Free. (Write Committee on Science and Astronautics, U. S. House of Representatives, George Washington Inn, Washington 25, D. C., for Hearings -- Research on Mechanical Translation.)

